The Serbian Society for Ceramic Materials
Institute for Multidisciplinary Research (IMSI), University of Belgrade
Institute of Physics, University of Belgrade
Center of Excellence for the Synthesis, Processing and Characterization of Materials for use in Extreme Conditions "CEXTREME LAB" - Institute of Nuclear Sciences "Vinča", University of Belgrade
Faculty of Mechanical Engineering, University of Belgrade
Center of Excellence for Green Technologies, Institute for Multidisciplinary Research, University of Belgrade
Faculty of Technology and Metallurgy, University of Belgrade

PROGRAMME and the BOOK of ABSTRACTS

6CSCS-2022

6th Conference of the Serbian Society for Ceramic Materials
June 28-29. 2022. Belgrade Serbia

Edited by:
Branko Matović
Aleksandra Dapčević
Vladimir V. Srdić

Programme and Book of Abstracts of The Sixth Conference of The Serbian Society for Ceramic Materilas **publishes abstracts from the field of ceramics, which are presented at international Conference.**

Editors-in-Chief
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Publisher
Institut za multidisciplinarna istraživanja
Kneza Višeslava 1, 11000 Belgrade, Serbia

For Publisher
Dr Dragica Stanković

Printing layout
Vladimir V. Srdić

Press
Faculty of Technology and Metalurgy, Research and Development Centre of Printing Technology, Karnegieva 4, Belgrade, Serbia

The year off issue:
2022.

ISBN 987-86-80109-23-7

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

666.3/.7(048)
66.017/.018(048)

DRUŠTVO za keramičke materijale Srbije. Konferencija (6 ; 2022 ; Beograd)
Programme ; and the Book of Abstracts / 6th Conference of The Serbian Society for Ceramic Materials, 6CSCS-2022, June 28-29, 2022, Belgrade, Serbia ; [organizers] The Serbian Society for Ceramic Materials ... [et al.] ; edited by Branko Matović, Aleksandra Dapčević, Vladimir V. Srdić. - Belgrade : Institut za multidisciplinarna istraživanja, 2022 (Belgrade : Faculty of technology and metalurgy, Research and development centre of printing technology). - 91 str. : ilustr. ; 25 cm

Tiraž 120. - Str. 7: Welcome message / Branko Matovic. - Registar.

ISBN 978-86-80109-23-7

а) Керамика -- Апстракти б) Наука о материјалима -- Апстракти
в) Наноматеријали -- Апстракти

COBISS.SR-ID 69088009

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THE IMPROVEMENT OF FERROELECTRIC PROPERTIES OF $BiFeO_3$ CERAMICS BY DOPING WITH La^{3+} AND Eu^{3+}

Danijela Luković Golić[1], Aleksandar Radojković[2], Nataša Jović Orsini[2], Aleksandra Dapčević[3], Goran Branković[1], Zorica Branković[1]

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Bismuth ferrite is a unique multiferroic material that has a ferroelectric and antiferromagnetic order at room temperature. The rhombohedrally (*R*3*c*) distorted $BiFeO_3$ perovskite structure is a result of relative cation displacement along [111] axis of the cubic perovskite structure and relative rotation of two oxygen octahedra in opposite directions around [111] axis [1]. The partial substitution of Bi^{3+} with rare-earth ions can affect the magnitude of lattice distortion and thus the value of electric polarization. The presence of undesirable secondary phases ($Bi_2Fe_4O_9$ and $Bi_{25}FeO_{39}$) and structural point defects (oxygen and bismuth vacancies) in pure $BiFeO_3$ lead to a high leakage current, which deteriorates its ferroelectric properties. Doping with rare-earth elements with large ionic radii is found to reduce the number of the structural defects and thus improve ferroelectric properties [2].

The influence of partial substitution of Bi^{3+} with La^{3+} and/or Eu^{3+} on ferroelectric properties of $BiFeO_3$ ceramics was investigated. The $Bi_{(1-x;1-y)}La_xEu_yFeO_3$ (x = 0, 0.025 0.05, 0.10; y = 0, 0.025, 0.05, 0.10) powders were synthesized by hydro-evaporation method, uniaxially pressed at 9 t/cm^2 and sintered at 835 °C for 3 h. All the ceramic samples showed a rhombohedral structure, without presence of the secondary phases. Their morphology indicated the complete sintering under the given conditions. The grain size and grain shapes differed more depending on the dopant type and amount. The introduction of La^{3+} and/or Eu^{3+} at the site of Bi^{3+} led to such distortions within the rhombohedral lattice that resulted in much greater remnant electric polarization (P_r) in comparison with the undoped sample. The $Bi_{(1-x;1-y)}La_xEu_yFeO_3$ ceramic samples with $x+y = 0.10$ showed approximately quadratic polarization vs. electric field $P(E)$ hysteresis curves as well as significantly high values of pure ferroelectric polarization P_r, in large electric fields (100–140) kV/cm. The leakage currents of La^{3+}/Eu^{3+}-doped samples are mostly reduced, especially those doped only with Eu^{3+}.

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